contraction are spirals, each very nearly at 45° to the length of the tube.

From the author's early experiments (described in his paper on Electrodynamic Qualities of Metals, published in the Transactions of the Royal Society for 1856), showing a diminution of electric conductivity by pulling force in metallic wires, and Mr. Tomlinson's recent confirmations and extensions of those results, it is to be expected that the conductivity of the substance will be less in the direction of extension and greater in the direction of contraction in the stressed substance than the conductivity (equal in all directions) of the substance when free from stress. Hence, if an electric current be maintained along a tube, torsion would cause it to flow in spiral stream-lines, with spirality of opposite name to that of the twist. The whole flow may be resolved into two components: one right along the tube, the other round it. The latter would (like the current through a galvanometer-coil) deflect a needle hung in the interior of the tube with its axis perpendicular to the tube when undisturbed. Or it would magnetise a bar or wire of soft iron placed within the tube. The current itself would (except near the end of the tube) produce no external effect directly; but either of those appliances may be used to give an external indication.

Since the last meeting of the Physical Society, when the author raised this question of the spiral electric stream lines in a twisted tube, experiments have been made for him by Mr. Macfarlane in the physical laboratory of the University of Glasgow, on the last-mentioned plan; and on the former plan by Mr. J. T. Bottomley in the physical laboratory of King's College, London, by kind permission of Prof. Adams, and with the valuable assistance of his staff. Mr. Macfarlane, using a small mirror magnetometer suspended externally in the neighbourhood of one end of an iron wire placed within a brass tube, found that when the twist of the substance was right-handed the end of the wire next that end of the tube by which the current enters becomes a true north pole. Mr. Bottomley, with the cell and suspended mirror and needle of an ordinary dead-beat mirror galvanometer supported by an independent support within a brass tube along which a current is maintained, found that the true north pole of the needle is moved towards the end of the tube by which the current enters. Thus both Mr. Macfarlane's and Mr. Bottomley's observations confirm the anticipation that the electric conductivity is least in the direction of greatest extension, and greatest in the direction of greatest contraction of the metal. The apparatus by which Mr. Bottomley had made his experiment was exhibited to the meeting. It included a mode of balancing the effect on the internal needle by placing a circular portion of the main circuit at a proper distance from it, the centre and plane of the circle being in and perpendicular to the axis of the tube. From a measurement of the distance from the centre of the circle to the needle, when the balance is obtained, the ratio of the maximum to the minimum conductivity can be calculated.

NOTES

We publish a remarkable paper this week, by Mr. J. Blyth, on a new form of the microphone, which needs neither battery nor telephone. The curious importance of Mr. Blyth's invention need not be insisted on. By backing-up the pictures in a drawing-room it might, as has been suggested by a learned professor, be converted into an Ear of Donysius, and Horace's words, "suppositos cineri doloso," would come to have an awful meaning.

At the Royal Society on Thursday last, all those proposed as new Fellows, and whose names we have already published, were unanimously elected.

Prof. Simon Newcomb has published as a Supplement to the "American Ephemeris and Nautical Almanac," a few instructions for the observation of the total eclipse of the sun on July 29. The instructions refer to the limits of path of the shadow, instruments, arrangements for observation, the actual observation, search for intra-mercurial planets, drawings of the corona, &c. Prof. Newcomb's paper is accompanied by a series of photolithographic maps of the part of the United States concerned. They include a region extended about 150 miles on each side of the limits of totality. These maps contain certain special features which will render them very useful to observers. For example, on the right-hand side of the track is found, at convenient intervals, the Washington mean time at which the centre of the total phase reaches the several points, where the times are marked. From each of these points a dotted line extends across the path of totality; this line is the projection of a diameter of the shadow at the time indicated, so that the middle of the total phase occurs at this time all along the dotted line. These, and other features, render these maps of special utility.

A letter has been received in London by Dr. George Bennett, of Sydney, from Signor L. M. D'Albertis, the New Guinea traveller, dated from Sydney, New South Wales, April 14, 1878, in which he says, "I have taken my passage in the *Garonne*, which leaves direct for London on the 1st of May next, and expect to arrive in London about June 15, when I hope to see you. It is my intention to bring all my ethnological and other collections of natural history with me."

A laboratory for the study of marine zoology, in connection with the biological department of the Johns Hopkins University, will be organised this summer at Fort Wool, about a mile from Old Point Comfort, Va. The fort contains commodious buildings for laboratories and dormitories. The necessary apparatus for collecting and studying marine animals, nets, dredges, microscopes, reagents, aquaria, tables, &c., as well as a small scientific library, will be provided by the University. Through the kindness of the Maryland Commissioner of Fish and Fisheries, the boats used by the Commission will be at the service of the laboratory. The laboratory is organised mainly with a view to the wants of advanced scientific investigators, and there will be no formal courses of lectures. There will, however, be accommodation for a few less advanced students, and suitable instruction will be furnished to meet their individual needs.

Botanists will be gratified to learn that the publication by Prof. Asa Gray of his great work upon the "Flora of North America" has been commenced, and will be continued as rapidly as practicable. Many years ago a work with the same title was started by Drs. Torrey and Gray and carried through the Compositæ, where it stopped. The vast extension of the field of American botany, consequent upon the discoveries in California, Oregon, and other regions west of the Mississippi, has made the want of a manual extremely imperative, and this will be furnished by the work referred to. For the purpose of better satisfying the wants of students the work begins with the Gamopetalæ immediately following the Compositæ, and the ground covered by the original "Flora" will be taken up after the other orders are completed. The entire work will consist of two volumes of about 1,200 pages each, the first part, now issued, embracing about 400 pages. The book is to be had from the curator of the Harvard Herbarium at Cambridge.

The Japanese Government, which is making such rapid strides towards modern civilisation, has just awakened to the necessity of preserving its forests, and stringent regulations have been passed, which shall not only hinder the too rapid destruction of the forests, but increase the area covered by woodlands.

A VERY interesting paper was recently read before the Asiatic Society of Japan, by a native of that empire, in which the records of the earthquakes in that insular region for the past fifteen centuries were carefully compiled and classified. It appears that since the year 406 A.D. the authorities of Yeddo and other large cities have preserved, almost without interruption to the present time, descriptions of all earthquakes occurring, with their accompanying phenomena. As a rule it has been observed that the great shocks were preceded by a rise of temperature and violent atmospheric perturbations. The general average of great earthquakes has been ten in the century. The average of the present century is, however, double that number, and in the ninth century there were no less than twenty-eight destructive earthquakes. The list referred to describes a total of 150 great earthquakes during the past fifteen centuries, and a host of minor shocks. It is certainly one of the most novel and valuable contributions to this department of meteorology, and it is to be hoped that it will appear in a form and language available for European *savants*.

THE Japanese Government are evidently also losing no time in extending their system of telegraphic communication, for we learn from a Japan contemporary that there are now 125 telegraph stations in the country, and it is estimated that there are 5,000 miles of wire in operation; 1,000 miles more are in course of construction, and still further extensions are contemplated. Considering that the first telegraph line for practical purposes was not erected in Japan before the end of 1869, the result achieved is by no means unsatisfactory.

WE have before us three small publications, which indicate the activity of scientific research, especially botanical, in the United States. 1. *The Botanical Directory of America for* 1878 shows an array of names which would compare favourably with the number that could be included in such a list in the old country. Even those who are aware how much good work has been done by American women in several branches of science would hardly be prepared to find so large a proportion of ladies as are to be seen in the present list. 2. *Jahresbericht des naturhistorischen Vereins von Wisconsin für das Jahr* 1877-78, is a record of the year's work of the Natural History Society for the remote State of Wisconsin, so largely settled by Germans. Though some of the papers are in English—including an interesting one by Dr. E. N. Bartlett on *Aspergillus*, detected by him as a parasite in the ear, causing partial deafness—the official language of the Society appears to be German. 3. "A Catalogue of the Flowering Plants and Higher Cryptogams growing within thirty miles of Yale College," published by the Berzelius Society, appears to be carefully executed. The total number of indigenous species is—1,037 flowering plants, 52 vascular cryptogams, and 221 Muscineæ, besides 196 introduced flowering plants. It is accompanied by a map.

"VIS MEDICATRIX NATURÆ." In the light of this venerable saw we do not think it inappropriate in these pages to support an appeal which Dr. Dawson W. Turner asks us to make on behalf of the thousands of patients in the hospitals in and around London. The true healing art is based on rigid scientific research, and one of the most effectual methods of assisting the physician's efforts is to keep the patient in a cheerful mood and divest his thoughts from himself and his afflictions. A potent means to this end is cheerful reading, and we are sure that in this direction many of our readers will be able to assist Dr. Turner in his beneficent mission. Mr. Turner finds that of this class of books none are so acceptable to the sick and suffering, who *can* read, as the cheap one-volume editions of the best of our standard novelists—Scott, Dickens, and Marryat, especially, and then Trollope, Miss Sewell, Mrs. Gatty, and a host of others. Dr. Turner rightly makes a point of excluding everything that is the least "sensational." The lighter sort of serials are also acceptable, such as *Good Words, Aunt Judy's Magazine, Leisure Hour*, and so forth, as well as picture- and scrap-books, especially if the leaves are pasted on linen. We would add that we are sure many of the patients would welcome some of our more popularly written illustrated scientific works, which tell of greater wonders than ever novelist imagined, and the reading of which, besides amusing the patients, would leave a solid residue of knowledge behind. Dr. Turner's address is 13, Salisbury Street, Strand, W.C.

IN the forthcoming *fête* to be given by the City of Paris, no less than 200 electric candles will be kept burning during the whole of the night in several parts of the city, besides the regular display, which has been increased since our last note.

SOME of our readers may remember that Leverrier proposed to the French government to extend weather-warnings not only to agriculturists but also to the men who risk their lives in collieries. The mournful accident which has occurred near Wigan recently adds force to Leverrier's proposal, and surely, on the chance of its preventing such accidents, the plan might be tried.

IN Lisbon and its vicinity there was a violent shock of earthquake, accompanied by a storm of wind, at eleven o'clock on Saturday night, the duration about six seconds, and the direction east to west. Much alarm was caused.

THE Société Française d'Hygiène Publique, has appointed a Commission for utilising the Giffard Captive Balloon in the study of questions connected with hygiene, such as the influence of rapid decrease of pressure on vital functions, the causes of vertigo, &c. A preliminary programme has been published already.

THE Congress of Hygiene appointed by the French Ministry for the occasion of the Exhibition, will take place at the Trocadero Palace in the month of August. A number of excursions of special interest will be organised on the occasion. The initiative committee meets every week on Wednesday at the Pavillon de Flore (Palais des Tuileries), in the room where the late Congress of Geography was recently held.

PROF. PELIGOT of Paris discusses, in a recent number of the *Ann. de Ch. et Phy.*, the composition of ancient glass, combining his own analysis with a careful study of all passages on the subject in ancient authors. The specimens which he examined all contained mixtures of soda and potash, with but minimal quantities of life—one-third to one-half of the amount used at present. Prof. Peligot comes to the conclusion that flint-glass was entirely unknown in ancient times.

FROM the recent report of the secretary of the Société Chimique de Paris, we notice that its membership is at present 383, consisting of 140 members dwelling in Paris, and 243 non-resident. The yearly receipts amount to over 15,000 francs, of which a third is saved for investment. The Society possesses now a capital of 44,000 francs. Its bi-monthly *Bulletin* forms a yearly volume of 1,200 pages, and has a circulation of over 400 outside of the Society.

WE recently drew attention to Winkler's remarkable lunar landscape, now being exhibited in London. Something even more extensive, if not, perhaps, quite so artistic, is to be attempted by an American artist, if he can procure a sufficient number of subscribers. Mr. Henry Harrison, of Jersey City, has already painted a picture of the moon three and a half days old, and although we have not seen it ourselves, it is so highly spoken of by Dr. H. Draper and Mr. Rutherfurd, that we do not hesitate calling our readers' attention to the artist's proposed publication. The picture represents the moon with the terminator at Mount Glacier, showing the earthshine on the surface in shadow in which some of the most prominent features, *i.e.*, the craters Copernicus and Tycho, the Appennine Mountains, and nearly all the "meres" are visible. Having submitted the work, Mr. Harrison tells us, to gentlemen of scientific repute, and being encouraged by their favourable criticisms, he has concluded, if a sufficient number of subscriptions can be obtained, to publish a work under the title of "Telescopic pictures of the Moon," in oil colour chromos (the only medium for facsimile reproduction of paintings) 2 feet in size, with an image of 18 inches in diameter, in six progressive pictures of the following phases:—1. Three days old crescent, terminator at Mount Glacier. 2. Five days old, terminator at the crater Katharina. 3. Seven days old, or first quarter. 4. Nine days old, sunrise at the crater Copernicus. 5. Full moon; and 6. Last quarter. An outline drawing with letter-press description, bearing the names and sizes of all objects, will accompany the work, which will be completed in about a year from the time the first phase has been issued, and will be furnished to subscribers complete for 30 dols., or 5 dols. for each plate. The description will appear gratuitously with the last issue. Subscribers should send full name and address to Henry Harrison, P.O. Box, 179, Jersey City, New Jersey.

A VERY successful experiment has been made at Lockport, New York State, in supplying heat to houses by steam supplied from a central station, in much the same way as gas is supplied. The experimental works in Lockport were commenced last year, and during the late winter about 200 houses in the city were heated from the central supply, through about three miles of piping, radiating from the boiler-house, containing two boilers 16 feet by 5 feet, and one boiler 8 feet by 8 feet. These boilers were, during the winter, fired to a pressure of 35 lb. to the inch, with a consumption of 4 tons of anthracite, costing 4½ dols. a ton during the summer, but one boiler is fired consuming a ton and a half of anthracite in twenty-four hours, and a pressure of 25 lb. per inch maintained. The boiler pressure of 35 lb. in winter, and 25 lb. in summer, is maintained through the entire length of the three miles of piping up to the points of consumption, where there is a cut-off under the control of the consumers. The distribution of heat in the apartments is by means of radiators, consisting of 1 inch pipes 30 inches long, placed vertically either in a circle or as a double row, and connected together, top and bottom, with an outlet pipe for the condensed water, which escapes at a temperature a little below boiling, and is sufficient for all the domestic purposes of the house, or is used as accessory heating power for horticultural and other purposes. The steam has also been applied at a distance of over half a mile from the boilers for motive power, and two steam-engines of ten and fourteen horse-power are worked from the boilers at a distance of half a mile, with but a slightly increased consumption of fuel. The laid on steam is being also used for cooking purposes, for boiling, and even baking, and Mr. G. Maur, F.G.S., who describes the system, witnessed in a house three quarters of a mile from the boilers, a bucket of cold water raised to boiler heat in three minutes by the passage of the steam through a perforated nozzle plunged in the bucket. The operations of the Heating Company have been up to the present time of an experimental character, and from the 200 houses already supplied with the heating connection, the actual cost of the coal that would have been used for heating has been provisionally received in payment, and the amount has left a wide margin over the working expenses, though the company's operations at present cover but a small portion of the area for which they have provided plant.

THE additions to the Zoological Society's Gardens during the past week include two Mandrills (*Cynocephalus mormon*), an Ocellated Monitor (*Monitor ocellatus*) from West Africa, presented by Mr. G. H. Garrett; two Greater Spotted Woodpeckers (*Picus major*), British Isles, presented by Mr. J. A. Cooper; a Greater Sulphur-crested Cockatoo (*Cacatua galerita*) from Australia, presented by Mr. N. Portocalis; a Horned Lizard (*Phrynosoma cornutum*) from Texas, presented by Mr. J. C. Witte; a Common Chameleon (*Chamæleon vulgaris*) from North Africa, presented by Mr. W. W. Spicer; two Indree Owls (*Syrnium indranee*) from Ceylon, deposited; two Common Seals (*Phoca vitulina*) from British seas, a White-fronted Amazon (*Chrysotis leucocephala*) from Cuba, two Oyster Catchers (*Hæmatopus ostralegus*), British Isles, purchased; two Horned Tragopans (*Ceriornis satyra*), an Impeyan Pheasant (*Lophophorus impeyanus*), bred in the Gardens.

THE ROYAL OBSERVATORY

THE annual visitation of the Royal Observatory took place on Saturday week, when the Astronomer-Royal read his Report, which refers to the year ending May 2

The Report on the buildings and grounds, movable property, manuscripts, library, astronomical instruments, &c., is, as usual, satisfactory. The new railway through the town of Greenwich has apparently had no effect at the observatory.

The usual varied astronomical observations have been carried on with the usual diligence, the advantageous observation of the small planets being, however, limited by the want of ephemerides.

To facilitate the observations of stars, a new working catalogue has been prepared, in which are included all stars down to the third magnitude, stars down to the fifth magnitude which have not been observed in the last two catalogues, and a list of 258 stars of about the sixth magnitude of which the places are required for the United States Coast Survey. The whole number of stars in the new working list is about 2,500. An extensive series of observations was made, during the autumn, of about seventy stars, at the request of Mr. Gill, for comparison with Mars, Ariadne, and Melpomene.

Among the observations made we may mention 3,970 transits, the separate limbs being counted as separate observations, and 3,824 circle observations, each requiring a separate reading of the six microscope micrometers. Twenty-nine sketches of Mars were obtained with the great equatorial near his opposition, forming a complete record of the appearances of that planet during the entire rotation. Preparations were made for observing the Transit of Mercury on May 6, but owing to the unfavourable state of the weather no result of importance was obtained. A great amount of work has been done in the reaction of astronononomical observations.

The computations for the "Nine-Year Catalogue" of 2,263 stars, including some supplementary investigations, were completed in the course of 1877, and the introduction has been prepared and sent to the printer. The catalogue is drawn up in the same form as previous catalogues, the only noteworthy alterations being the addition of another decimal place to the R.A.'s and annual precessions in R.A., which are carried to $0^{s}\cdot001$ and $0^{s}\cdot0001$ respectively. The right ascensions are thus made to correspond more nearly with the north polar distances as regards the degree of accuracy exhibited.

During the past year the sun's chromosphere has been examined with the spectroscope on seventy-nine days (on two of these through part of the circumference only); prominences were seen on fifty-eight days. All the observations, however, tend to show that the solar prominences have been few in number and insignificant in size for many months.

All observations with the spectroscope have been completely reduced; the position-angles of prominences being converted into heliographic N.P.D.; and the displacements of lines in the spectra of stars being reduced so as to exhibit the concluded motion in miles per second, after applying a correction for the earth's motion.

The areas, position-angles, and distances from the sun's centre, of sun-spots and faculæ, have been measured to the end of 1877, and in duplicate July 5, 1877.

The correction of the position-angles and distances for the effects of refraction and distortion, and their conversion into heliographic longitude and latitude, have been pushed forward as rapidly as circumstances would admit after the measurements had been completed. As there is a considerable accumulation of arrears since 1873, which will require many months for their reduction, it has seemed desirable to commence with the year 1876, with the view of including in the volume for 1876 the